LPe15004, LPe16004, and LPe16000B-series HBA Installation Manual

Emulex Connects™ Servers, Storage and People

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Emulex, 3333 Susan Street
Costa Mesa, CA 92626

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1. Introduction

Overview

This manual describes the following Fibre Channel (FC) to Peripheral Component Interconnect Express (PCIe) Emulex® host bus adapters (HBAs):

- LPe15004, 8 gigabit per second (Gb/s)
- LPe16000B, LPe16002B, and LPe16004, 16 Gb/s

The core technology of these HBAs is Emulex's 10th generation FC controller. The controller is a multi-function PCIe Gen3 interface controller that is compliant to the PCI Express Base Specification Rev 3.0 and PCI Express CEM Specification Rev 3.0. The LPe16000B is a single-channel adapter, the LPe16002B is a dual-channel adapter, and the LPe15004 and LPe16004 are four-channel adapters.

These HBAs support packet transfers at 2.5, 5.0, and 8 gigatransfers per second (2.5, 5.0, and 8 GT/s) on the PCIe link (auto-negotiated with the system). The supported physical PCIe connector is x8. The fully featured FC port is compliant to various American National Standards Institute (ANSI) FC standards.

Note: Illustrations in this manual are only examples. The actual hardware may vary.

Major Features

- Multi-function PCIe 3.0 device with one (LPe16000B), two (LPe16002B), or four (LPe15004 and LPe16004) independent FC ports.
- Auto-negotiation between 4-Gb/s, 8-Gb/s, or 16-Gb/s (LPe16000B, LPe16002B, and LPe16004 adapters only) FC link speeds.
- Complies with the PCIe base and CEM 3.0 specifications.
- x8-lane standard Generation 3, PCIe interface at 2.5GT/s, 5GT/s, or 8GT/s (auto-negotiated with the system).
- ECC protection of high density RAM (single-bit correction, double-bit detection).
- SFP+ interface supporting optics with LC connections and digital diagnostics capability.
- Host interface support is provided through Emulex standard drivers.
  - The LPe15004 adapter supports Windows Server 2012, Windows Server 2008, Windows Hyper-V, Citrix, Kernel-based Virtual Machine (KVM), VMware ESXi, Red Hat Enterprise Linux (RHEL), SUSE Linux Enterprise Server (SLES), Oracle Enterprise Linux (OEL), and Solaris S11 (x86 and Solaris Sparc)
  - The LPe16000B-series adapters supports Windows Server 2008 R2 and WS 8, Red Hat Enterprise Linux, VMware ESXi, and Solaris S11 (including Comstar).

- The LPe16004 adapter supports Windows Server 2008 R2, Windows Server 2012, Linux 2.6 Kernel, VMware ESXi, Solaris 11 (including Comstar), Target Mode Drivers (TM Kits 9.6 and 9.7), FreeBSD, and Debian.

- Parts and construction are compliant to the European Union Directive of Restriction of Hazardous Substances (RoHS).

Compatibility

Table 1-1 Software and Hardware Environments

Software Environments	See the HBA's website for compatible operating systems.
Hardware Environments	LPe15004: PCIe 3.0 supports x8, x4, x2, and x1. LPe16004, LPe16000B, and LPe16002B: PCIe 3.0 supports x8, x4, and x1. **Note:** HBAs are PCIe 3.0 and CEM 3.0 compliant systems and are backwards compatible to 1.0a, 1.1, and 2.0 compliant systems.

Prerequisites

Use PCIe Gen 3 compliant systems that are x8 or x16 lane at up to 8 GT/s per lane.

HBA Identification

Each HBA ships with several numbers clearly marked on the board. Emulex recommends recording these numbers before installation.

- Serial number – assigned by Emulex. Use this number when communicating with Emulex.
- IEEE address – an Institute of Electrical and Electronics Engineers (IEEE) unique 64-bit identifier used for system configuration
- World Wide Name (WWN) – derived from the IEEE) address, the FC industry uses the WWN for FC connectivity.

Note: IEEE addresses and WWNs are assigned in sequential order. For example, if an adapter has four ports, it has four IEEE addresses and four WWNs; one for each port with the second, third and fourth IEEE addresses/WWNs being the next successive number of the first.

2. Installation

The standard HBAs can be connected to fiber optic cables.

Preparing the HBA for Installation

The Emulex LPe16004, LPe16000B, and LPe16002B HBAs use removable optical transceivers. If you need to change the bracket for an HBA installation, you must first remove the optical transceiver(s), if installed, from the housing (cage). This procedure explains how to remove the transceiver and bracket safely.

Note: The LPe15004 HBA comes with a low–profile PCIe bracket installed.The low–profile mounting bracket is shorter than the standard bracket; approximately 3.11 inches (7.9 cm) compared to 4.75 inches (12.06 cm) long.

Note: On the LPe15004 HBA, you can remove and change the bracket but you cannot remove the optical transceiver.

Note: The LPe16004, LPe16000B, and LPe16002B HBAs come with a standard full–height PCIe bracket installed.

To change the bracket:

1. Some HBAs have optical transceivers embedded in their cage assemblies. These optical transceivers must be removed before the bracket can be removed. If the HBA contains optical transceivers, continue with the following steps; otherwise, proceed to step 4.

   Caution: This is a delicate operation. Take care not to damage the optical transceiver.

   The HBA uses different types of optical transceivers. Figure 2-1 shows an example of one type with the bail (handle) extended.

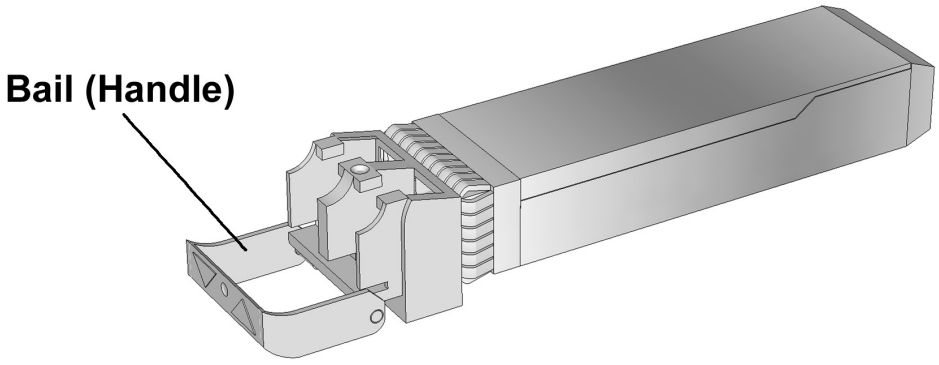

Figure 2-1 Typical Optical Transceiver

2. To remove a transceiver, pull the bail (handle) out and down to release the latch and gently pull the transceiver out. Do not force it. After the latch is released, the transceiver slides out easily.

Figure 2-2 shows a transceiver with the latch released (bail extended) and another transceiver latched in place.

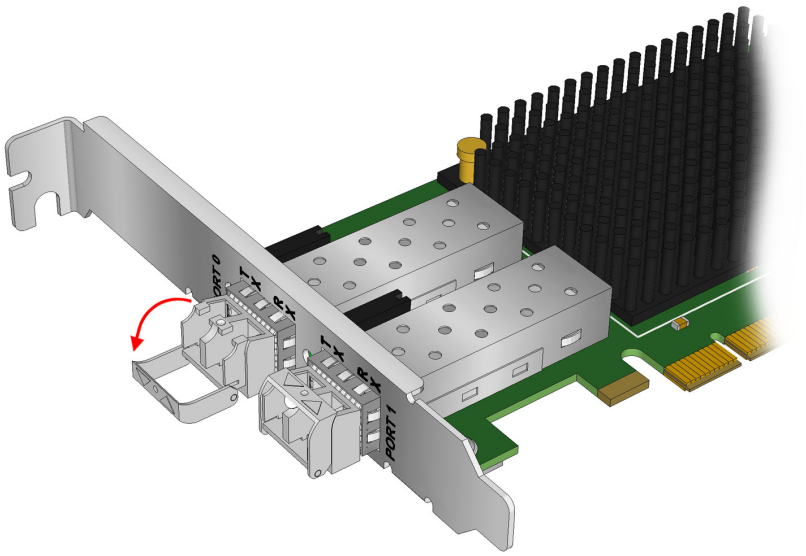

Figure 2-2 Releasing the Latch on an Optical Transceiver

Figure 2-3 shows an extracted transceiver and another transceiver latched in place.

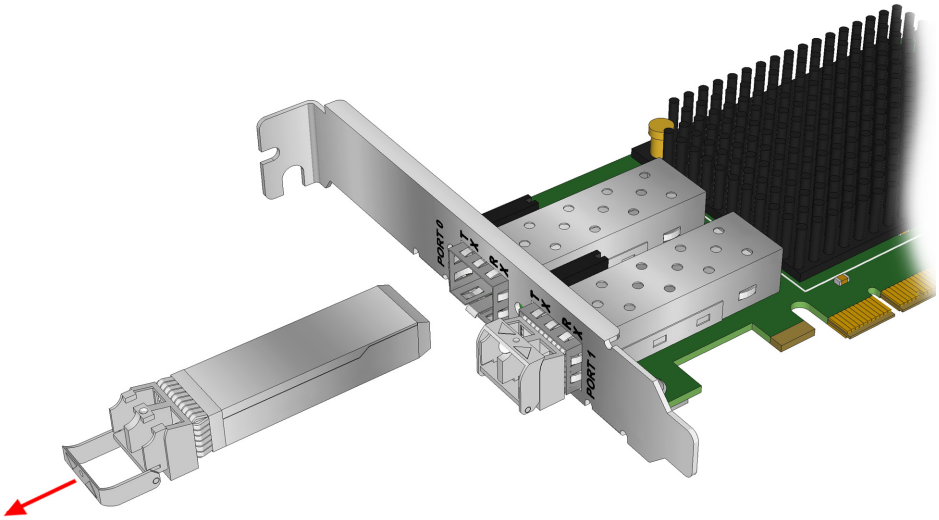

Figure 2-3 Removing an Optical Transceiver

3. Observing Electrostatic Discharge (ESD) precautions, store the transceiver in an ESD-safe place.

4. Remove the mounting bracket screws from the top of the HBA. Figure 2-4 shows the screws that are removed from the bracket.

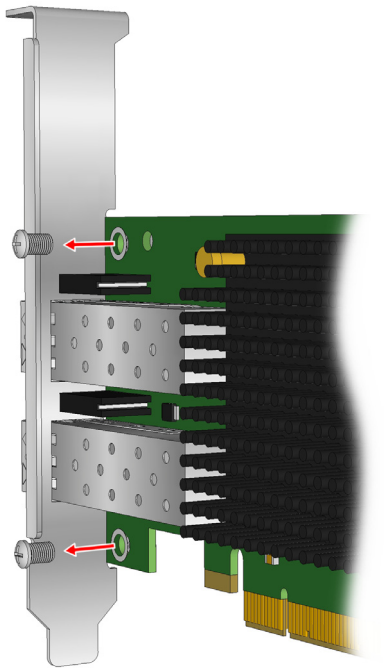

Figure 2-4 Removing the Bracket

5. Remove the bracket and store it for future use.
6. Align the new mounting bracket tabs with the holes in the HBA.

   Note: Be careful not to push the bracket past the EMI compression tabs of the SFP cage. Ensure the light emitting diodes (LEDs) are properly aligned with the holes in the bracket.

7. Re-install the screws that attach the HBA to the bracket.
8. Re-install the transceiver by sliding it into the housing. When the latch engages, it clicks.
9. Push the bail back into place.

Installing the Adapter

To install the adapter:

1. Turn off the computer if hotplug is not supported on the server. See your server documentation to see if it supports Hot Plug/Hot Swap of PCIe adapter cards.
2. Remove the computer case.
3. Remove the blank panel from an empty PCIe bus slot. See “Preparing the HBA for Installation” on page 8 to change the brackets if needed. Otherwise, proceed to “Attaching Media” on page 11.

4. Insert the HBA into an empty PCIe x8 or x16 slot. Press firmly until the adapter is seated.

   Note: Make sure that the adapter is in an appropriate PCIe slot that does not interfere with other components or with the case to prevent damage to the HBA.

5. Secure the HBA mounting bracket to the case with a panel screw or clip.
6. Replace the computer case and tighten the case screws.

The HBA is now installed in the server and is ready for an FC device.

Attaching Media

Note: The HBA does not allow normal data transmission on an optical link unless it is connected to another similar or compatible laser product (that is, multimode to multimode.)

Note: The HBA does not automatically downgrade to the required FC speed based on cable length. You must downgrade the speed with the appropriate utility or link errors may occur.

Use a multimode fiber optic cable, with short-wave lasers, that adheres to the following specifications:

Table 2-1 Media Specifications

Fiber Optic Cable	Maximum Length	Minimum Length	Connector
OM4 - Multi-mode 50/125 micrometer fiber (4700 MHz*km bandwidth cable)	4GFC: 0.5m - 400m 8GFC: 0.5m - 190m 16GFC: 0.5m - 125m	0.5 meters	LC
OM3 - Multimode 50/125 micron fiber (2000 MHz*km bandwidth cable)	4GFC: 0.5m - 380m 8GFC: 0.5m - 150m 16GFC: 0.5m - 100m	0.5 meters	LC
OM2 - Multimode 50/125 micron fiber (500 MHz*km bandwidth cable)	4GFC: 0.5m - 150m 8GFC: 0.5m - 50m 16GFC: 0.5m - 35m	0.5 meters	LC
OM1 - Multimode 62.5/125 micron fiber (200 MHz*km bandwidth cable)	4GFC: 0.5m - 70m 8GFC: 0.5m - 21m 16GFC: 0.5m - 15m	0.5 meters	LC

To attach media to the HBA:

1. Connect the appropriate cable to the HBA.

   When connecting an optical cable, ensure the cages have optical transceivers installed in them (see Figure 2-5).

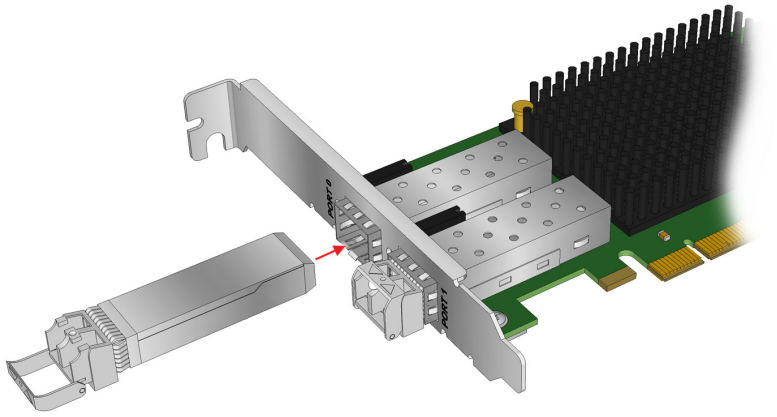

Figure 2-5 Installing an Optical Transceiver

Once the optical transceivers are installed, insert the optical cable into the LC connectors on the HBA (see Figure 2-6).

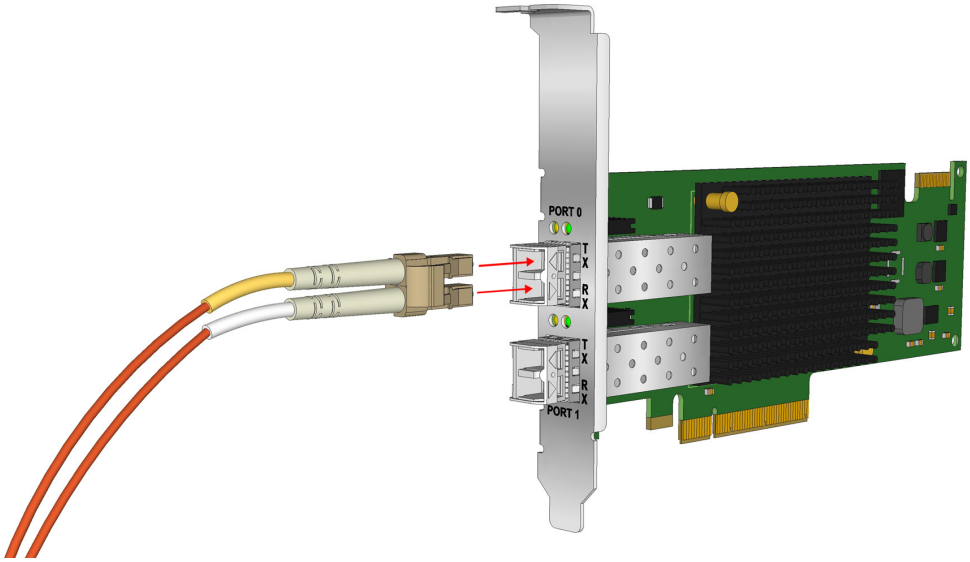

Figure 2-6 Connecting a Fiber Optic Cable

2. After the appropriate cable is connected to the HBA, connect the other end to the FC device.

   After the cable is connected to the HBA, you are ready to apply power to the computer.

Applying Power

To apply power:

1. Verify that the HBA is securely installed in the computer.
2. Verify that the correct media is attached.
3. Plug in and turn on the computer.
4. Watch the LEDs for Power On Self Test (POST) results.

Viewing the LEDs

You can view green and yellow LEDs through openings in the HBA's mounting bracket. The green LED indicates firmware operation and the yellow LED indicates port activity or link speed. Each port has a corresponding set of green and yellow LEDs as shown in the figure below.

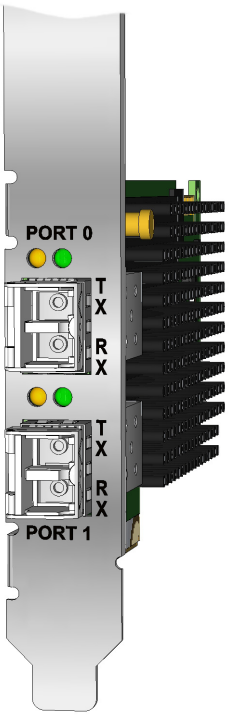

Figure 2-7 Optical HBA LED Indicators

POST Conditions and Results

POST is the default mode of self-test for the LPe15004, LPe16004, and the LPe16000B-series HBAs. No jumpers or connectors are necessary for this test to run. These tests perform a quick confidence level check of the HBA before running the operational software.

At a minimum, the following tests are performed by POST:

- Flash boot image checksum test

- Internal ASIC RAM tests for proper ECC and parity operation
- NLPort loopback test

The following table summarizes POST conditions and results:

Note: For the Link Rate conditions, there is a 1 second pause when the LED is off between each group of fast blinks (2, 3, or 4). Observe the LED sequence for several seconds to be sure you have correctly identified the pattern.

Table 2-2 POST Conditions and Results

Green LED	Yellow LED	State
Off	Off	Boot failure (Dead board)
Off	On	POST failure (Dead board)
Off	Slow Blink	Boot failure after POST
Off	Fast Blink	Not Defined
Off	Flashing	POST processing in progress
On	Off	Failure in Common Code Module
On	On	Failure in Common Code Module
On	1 Fast Blinks	Normal (Link up at 2GFC) (legacy compatibility only)
On	2 Fast Blinks	Normal (Link up at 4GFC)
On	3 Fast Blinks	Normal (Link up at 8GFC)
On	4 Fast Blinks	Normal (Link up at 16GFC)
On	Flashing	Not Defined
Slow Blink	Off	Normal-link down
Slow Blink	On	Not Defined
Slow Blink	Slow Blink	Not Defined
Slow Blink	Fast Blink	Not Defined
Slow Blink	Flashing	Not Defined
Fast Blink	Off	Not Defined
Fast Blink	On	Not Defined
Fast Blink	Slow Blink	Not Defined
Fast Blink	Fast Blink	Beaconing
Fast Blink	Flashing	Not Defined

3. References

LPe15004, LPe16004, and LPe16000B-series HBA Specifications

The specifications of the LPe15004, LPe16004, and LPe16000B–series HBAs are listed in Table 3-1.

Table 3-1 LPe15004, LPe16004, and LPe16000B-series HBA Specifications

Parameter	Range
Physical Dimensions	LPe16000B-series and LPe15004 HBAs: Low-profile form factor, 6.600 inches by 2.731 inches. LPe16004 HBA: Standard height, half length form factor, 6.600 inches by 4.376 inches.
Power Requirements	Single channel LPe16000B HBA: 9.3W (typical), 11.6W (maximum) Dual channel LPe16000B HBA: 11.1W (typical), 13.3W (maximum) Quad channel LPe16004 HBA: 22.4W (typical), 25.0W (maximum) Quad channel LPe15004 HBA: 11.5W (typical), 14.2W (maximum)
Power Susceptibility	The LPe16004,LPe16000B-series, and LPe15004 HBAs can operate within the following voltage ranges: PCIe 3.3V: 3.3V +/- 9% PCIe 12V: 12V +/- 8%Power supply noise susceptibility: 100mV p-p at frequencies 100KHz or less
Airflow	200 linear feet per minute (minimum, LPe16000B-series and LPe15004 HBAs) 250 linear feet per minute (minimum, LPe16004 HBA)
Temperature	0°C to 55°C (operating,LPe15004) 0°C to 50°C (operating, LPe16004 and LPe16000B-series HBAs) -40°C to 70°C (storage, LPe15004, LPe16004, and LPe16000B-series HBAs) **Note:** Operating HBAs in higher temperature conditions may result in early failure.
Humidity	LPe16004 and LPe16000B-series HBAs: 5% to 95% (non-condensing, 22°C wet bulb) for storage 10% to 90% (non-condensing, 22°C wet bulb) for operation LPe15004 HBA: 5% to 95% (non-condensing, 23°C wet bulb) for storage 10% to 90% (non-condensing, 23°C wet bulb) for operation

Table 3-1 LPe15004, LPe16004, and LPe16000B-series HBA Specifications (Continued)

Parameter	Range
Agency Approvals for LPe15004, LPe16004, and LPe16000B-series HBAs	• Class 1 Laser Product per DHHS 21CFR (J) & EN60825-1 when equipped with approved optical devices • UL recognized to UL60950-1 2nd Edition • cUR recognized to CSA 22.2, No. 60950-1-07 • TUV certified by to EN60950-1+A11+A1+A12 • FCC Rules, Part 15, Class A • Industry Canada, ICES-003, Class A • EMC Directive 2004/108/EEC (CE Mark) ❍ EN55022:2010, Class A ❍ EN55024:2010 • Australian EMC Framework (C-Tick Mark) ❍ AS/NZS CISPR22:2009+A1, Class A • Japan VCCI, Class A • Taiwan BSMI, Class A • Korea KCC, Class A • RoHS Compliant (Directive 2011/65/EU) • China RoHS compliant
Vibration, peak acceleration	0.25g (5 Hz to 500 Hz) (Sweep Rate = 1 octave/minute)

FCC and Regulatory Notices

LPe15004, LPe16004, and LPe16000B-series HBA Models

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party:

Jeff Benck, President and Chief Executive Officer
Emulex Corporation (714) 662-5600
3333 Susan St. Costa Mesa, CA. 92626 USA

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. The reader is cautioned that changes or modifications made to the equipment not expressly approved by Emulex

could void the user's authority to operate this equipment. The above statement applies to products marketed in the USA.

This class A digital apparatus meets all requirements of the Industry Canada (IC) Interference - Causing Equipment Standard (ICES-003).

Cet appareil numérique de la classe A respecte toutes les exigences du règlement sur le matériel brouilleur du Canada. CAN ICES-3 (A)/ NMB-3 (A)

Notice for Japan and Translations (VCCI)

この装置は、クラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI-A

Translation:

This is a Class A product. If this equipment is used in a domestic environment, radio interference may occur, in which case, the user may be required to take corrective action. VCCI—A.

Notice for Taiwan and Translations (BSMI)

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Translation:

This equipment is a Class A ITE, and operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

Notice for South Korea and Translations (KCC)

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

Translation:

Sellers and users of this equipment take note that this equipment is EMC approved for Class A industrial use, and as such is not intended for residential use.

Declarations of Conformity

LPe16004 and LPe16000B-series HBA Models

This equipment complies with CISPR22/EN55022 Class A.

WARNING: This is a class A product. In a domestic environment, this product may cause radio interference requiring the user to take adequate measures.

Note: Changes or modifications not expressly approved by Emulex Corporation, including the use of non-Emulex approved optical transceivers, could void the user's authority to operate this equipment.

DECLARATION OF CONFORMITY

Manufacturer: Emulex Design and Manufacturing Corporation
3333 Susan Street
Costa Mesa, CA. 92626 USA

declares under sole responsibility that the product:

Product Name: LightPulse® HBA / OneConnect® UCNA
Regulatory Model: P005947, P007976
Assembly Number: P005947-xxx, P007976-xxx *(x=alphanumeric)*

To which this Declaration relates is in conformity with the following standards or other documents for Information Technology Equipment (ITE):

Product Safety:
UL Recognized to UL 60950-1:2007, Second Edition
cUR Recognized to CSA 22.2, No. 60950-1-07
IEC 60950-1:2005 +A1 (CB Scheme)
EN 60950-1:2006 +A11 +A1 +A12
EN 60825-1:2007*
CFR Title 21, Laser AEL Class 1, FDA/CDRH*
** when equipped with approved optical transceivers*

Electromagnetic Compatibility (Class A):
FCC Rules, CFR Title 47, Part 15, Subpart B
Industry Canada, ICES-003:2012 (Issue 5)
EN55022:2010 / CISPR 22:2008
EN55024:2010 / CISPR 24:2010
AS/NZS CISPR22:2009
VCCI:2010
CNS 13438:2006, KN22, KN24

Hazardous Substances:
The object of this declaration described above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, and has been validated per EN 50581:2012.

Supplementary Information:
1. The product was tested in a typical configuration.
2. The product is in compliance with the following directives:
   - European Union Low Voltage Directive 2006/95/EC
   - European Union Low EMC Directive 2004/108/EC
   - European Union RoHS Directive 2011/65/EU
   - Australian C-Tick Mark framework

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Costa Mesa, CA

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President and Chief Executive Officer

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LPe15004 HBA Models

This equipment complies with CISPR22/EN55022 Class A.

WARNING: This is a class A product. In a domestic environment, this product may cause radio interference requiring the user to take adequate measures.

Changes or modifications not expressly approved by Emulex Corporation could void the user's authority to operate this equipment.

DECLARATION OF CONFORMITY

Manufacturer: Emulex Design and Manufacturing Corporation
3333 Susan Street
Costa Mesa, CA. 92626 USA

declares under sole responsibility that the product:

Product Name: LightPulse® HBA
Regulatory Model: P007729
Assembly Number: P007729-xxx *(x=alphanumeric)*

To which this Declaration relates is in conformity with the following standards or other documents for Information Technology Equipment (ITE):

Product Safety:
UL Recognized to UL 60950-1:2007, Second Edition
cUR Recognized to CSA 22.2, No. 60950-1-07
IEC 60950-1:2005 +A1 (CB Scheme)
EN 60950-1:2006 +A11 +A1 +A12
EN 60825-1:2007
CFR Title 21, Laser AEL Class 1, FDA/CDRH

Electromagnetic Compatibility (Class A):
FCC Rules, CFR Title 47, Part 15, Subpart B
Industry Canada, ICES-003:2012 (Issue 5)
EN55022:2010 / CISPR 22:2008
EN55024:2010 / CISPR 24:2010
AS/NZS CISPR22:2009 +A1
VCCI:2012
CNS 13438:2006 (Complete), KN22, KN24

Hazardous Substances:
The object of this declaration described above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, and has been validated per EN 50581:2012.

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   - European Union Low EMC Directive 2004/108/EC
   - European Union RoHS Directive 2011/65/EU
   - Australian C-Tick Mark framework

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Laser Safety Notice

Emulex products incorporating optical laser transceivers contain Class 1 laser devices, which comply with DHHS/CDRH 21CFR Sub-chapter J, and the international laser safety standard EN/IEC 60825-1. Class 1 laser devices are not considered to be hazardous.

The use of non-Emulex approved optical transceivers, or transceivers which do not comply with the Class 1 radiation performance requirements defined in DHHS/CDRH 21CFR Sub-chapter J and IEC 60825-1, may expose the user to hazardous laser radiation, and such devices should not be used with Emulex products.